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DEANE, NOLA ELIZABETH

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Country of Birth — Lieu de naissance
CANADA

Permanent Address — Résidence fixe
12308 ASPEN DRIVE WEST
EDMONTON, ALBERTA T6J 2G2

Title of Thesis — Titre de la thèse
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UNIVERSITY OF ALBERTA (EDMONTON)

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READING COMPREHENSION PROCESSES OF HIGH AND LOW DIVERGENT THINKERS

by

NOLA DEANE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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Grace Malicky
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Date September 27, 1984

ABSTRACT

Much of the literature assumes that the reading processes for all good readers are the same. However studies on cognitive styles suggest that different people think and learn in different ways. One dimension on which people differ is in their ability to think divergently, to draw from a wide variety of past experiences to solve open-ended kinds of problems. The purpose of this study was to compare the reading processes of high divergent and low divergent good readers.

Forty grade six students who scored above the seventy-fifth percentile on the Edmonton Public Schools' Elementary Reading Test (comprehension section) participated in the study. Twenty had obtained high scores on the Torrance Test of Creativity (Verbal) and twenty had obtained low scores. The groups were equated for IQ.

The students read a five hundred word narrative selection following which they gave an unaided oral recall and completed a sentence verification task. Subjects also answered two questions regarding the processes they were aware of using during the reading comprehension process. The recalls and the answers to the questions were tape recorded and later transcribed. Recall clauses were categorized according to the degree of similarity to the text. This classification system was also used to construct the sentence verification task.

Statistical treatment of the data included Hotelling's multivariate analysis and Pearson's correlations. The findings indicated no significant difference in the reading processes of the high divergent and low divergent groups when all categories were

compared simultaneously using the recall or the sentence verification data. However, there were some significant differences between groups on recall data when each category was considered separately. High divergent thinkers gave a greater percentage of recall clauses in the text experiential category, indicating that they were using the process of associating combined with the process of elaborating more than low divergent thinkers. Correlation data also indicated a significant positive relationship of the percentage of recall clauses in the text experiential category with scores on the Torrance test. There was a significant negative correlation of the percentage of clauses in the text specific category with divergent thinking.

Sentence verification data indicated that there was a significant difference between groups in the text inferential category which showed that high divergent students made more use of their past experience to "fill in the gaps" in the text. Correlation data for the sentence verification task indicated that divergent thinking was negatively related to scores on the text entailed category. Items in this category required readers to subsume material from different parts of the text under a superordinate statement.

It was concluded that the results of both tests indicated that similar processes were used by both groups. However, the fact that the data comparing individual categories within both the recall and the sentence verification test gave different results, suggests that there are important differences in what each test is measuring. Divergent thinkers performed better on the unstructured unaided recall task; less divergent students performed better on the structured sentence verification task.

In planning further research, particular attention should be paid

to the use readers make of inferences to "fill in the gaps" or elaborate. Researchers should question what effect the structure of their task has on the performance of their subjects and therefore the results of their studies.

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CHAPTER I

INTRODUCTION AND PROBLEM

Although it has been recognized for many years that comprehension is the heart of the reading process, it is only in the past decade that reading comprehension has been studied intensively. Studying the reading comprehension process is difficult because reading is a complex and covert process in which a reader's strengths in one area compensate for weaknesses in other areas. An underlying assumption of much research, particularly that on differences between good and poor readers, is that good readers are a fairly homogenous group in terms of the reading processes they employ. This is an assumption that needs to be tested. Research on cognitive style suggests that there are a variety of ways of learning for both good and poor readers. Hence, the generalized concept of one kind of good reader may be unrealistic. Therefore, to more adequately understand the reading process it would be advantageous to study some aspects of the differences in good readers. This research was designed to study the differences in the reading comprehension processes used by two groups of readers who differ in the basic thinking processes which they utilize.

Two dimensions, or different kinds of thinking, which have been used to categorize the thought process are divergent and convergent. Divergent thinking has the goal of producing a variety of ideas, all of which are logically possible in view of the given information. That is, divergent production is a broad search, usually to solve an open problem, in which there are a number of possible answers. The

convergent thinking process uses the given information to produce the recognized best or conventional conclusion. It is a focused search because the nature of the problem requires one particular answer. Guilford viewed the difference between these two productive (or thinking) operations as being relative, as depending on the degree of restraint or limitation on the desired answer (Guilford, 1975). The focus of this study was on students who differ in divergent thinking ability.

Purpose of the Study

The major purpose of this study was to compare the reading processes used by good readers who were high in divergent thinking ability with good readers who were low in divergent thinking ability. Two products of the reading process were used to make inferences about the reading process itself. Following the silent reading of connected discourse, an oral recall and a structured sentence verification task were performed by each subject. From the results of these tasks, inferences were made about the reading process. Each student was then asked two questions relating to his/her comprehension process.

Definition of Terms

Good Readers: Sixth grade students who performed at or above the seventy-fifth percentile on the Edmonton Public Schools' Elementary Reading Test, Grade Five Level, in May of their grade five year.

Reading Comprehension: A complex of processes involved in bringing meaning to the printed page and interacting with that written message in order to communicate with the author (McLeod, 1978).

Reading Processes: Cognitive behaviors underlying strategies used by the reader to interpret and give meaning to written discourse (Fagan, 1983, p. 6-36).

Divergent Thinking: "...a broad search, usually in an open problem, in which there are a number of possible answers." "The generation of logical alternatives." (Guilford, 1975, p. 40).

Continuous Discourse: The meaningful connected language of a passage which is read silently or narrated.

Recall Protocol: The verbatum transcript of the oral language output during the unaided recall.

Hypotheses

1. There will be no significant difference in the reading processes of good sixth grade readers who are high in verbal divergent thinking abililty from those who are low in verbal divergent thinking ability as inferred from the oral recalls.

2. There will be no significant difference in the reading processes of good sixth grade readers who are high in verbal divergent thinking ability from those who are low in verbal divergent thinking abilty

as inferred from the sentence verification task.

Limitations of the Study

1. As the sample was drawn from a sixth grade population of good readers from the middle and upper middle class, the findings can only be generalized to similar populations.

2. The assumption has been made that by studying the products of reading comprehension, that is, the recalls and the results of the sentence verification task, one can make inferences about the reading process itself.

3. The percentage of recalls in each category was calculated for divergent thinkers and for non-divergent thinkers because the average length of recall for the former was twenty per cent longer than that for the latter. This method of dealing with the problem of differences in verbal fluency may have affected the results in unforseen ways.

Significance of the Study

Knowledge of the differences in the reading processes of good readers is an important step in developing a more accurate theory of reading, one which is better able to explain the process of reading for a wide variety of different kinds of readers. This expanded knowledge should eventually lead to a more practical approach to the effective teaching of reading.

Plan for Investigation

Chapter I contains the introduction and statement of the problem, the purpose of the study and the hypotheses. The limitations and significance of the study are discussed.

In Chapter II a review of the literature is presented. The design of the study is detailed in Chapter III. The findings of the study and a discussion of the results are contained in Chapter IV. Finally, a summary of the study, the conclusions and implications, and suggestions for further research are presented in Chapter V.

CHAPTER II

RELATED LITERATURE

Introduction

In this chapter selected literature is reviewed to provide a theoretical framework for the study of the differences in the reading processes of divergent and less divergent thinkers. This chapter is divided into four sections. First there is a brief overview of reading as a thinking process. Cognitive styles are discussed. The second section reviews the literature on reading as an interactive process. Then some studies on reading and divergent thinking are reviewed. Finally, a section on evaluation of reading comprehension deals with the literature on oral recalls and the sentence verification technique.

Reading as a Thinking Process

It has been recognized for decades that reading is a thinking process (Mann, 1838 in Stauffer, 1975; Huey, 1908; Thorndide, 1917; Gray, 1925; Adler, 1940; Gates, 1949; Stauffer, 1975). The thinking process itself has been studied since at least the time of Aristotle (circa 450 B.C., Whittaker, 1965, p. 254) but as the study of thinking became more scientific such a broadly defined topic had to be subdivided into manageable subtopics.

Bartlett (1958) conducted experiments on memory and thinking from the time of the first World War. He subdivided thinking into

closed-system and open-system types.

> Closed-system thinking involves filling in gaps without moving beyond the information or evidence already available within the field of the gap itself. Thus, thinking that occurs in mathematics or logic is an example of this type. Open-system, or adventurous, [sic] thinking involves filling gaps by moving out of the bounds of the system within which the gap originally occurred. Most scientific thinking is of this type. (Bartlett, 1965 p. 347)

A more elaborate model was designed by Guilford (1959a, 1959b). His Structure of the Intellect (SI) model of the domain of human intellectual activity has three dimensions: contents, the environmental information discriminated by a person; operations, the intellectual processing of that information; and products, the forms that the information takes after processing.

Using the sub-categories under these three headings Guilford hypothesized a possible 120 combinations (categories) of intellectual factors. Guilford viewed divergent production as the operation having "the most to do with creative behavior" (Guilford, 1975, p. 42) and his concepts have had a particularly significant impact on research pertaining to creativity. (See Figure 1)

In addition, some of Guilford's Structure of the Intellect categories have been used to investigate the thinking processes which are used in reading. Of greatest interest to the study of reading comprehension are the operations of convergent and divergent production, cognition, memory and evaluation. Guilford defined divergent thinking as the type of productive thinking (retrieval from memory) directed to open-ended kinds of problems for which there is no one correct answer. Convergent thinking was defined as mental activity which attempts to follow the prescribed and tested forms of analysis to find the one correct answer or most conventional answer. He

regarded convergent thinking and divergent thinking as independent variables. Guilford theorized that each cell denoted a unique intellectual ability.

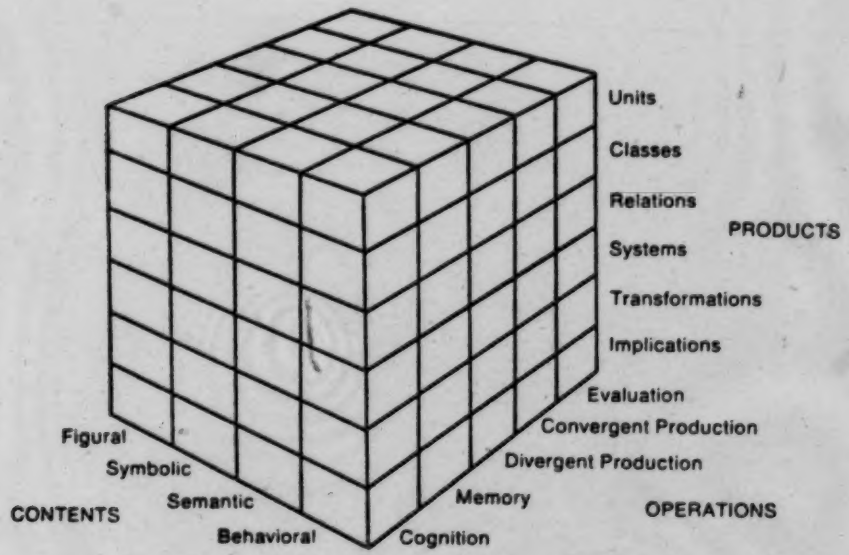

Figure 1 . Structure of the Intellect Model (Guilford, 1975)
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Using Guilford's categories of semantic and figural production Torrance (1966) devised two tests: Thinking Creatively With Words and Thinking Creatively With Pictures . The verbal test measured fluency (the number of scorable answers), flexibility (the number of different categories into which responses may be classified), and originality (with infrequent or more original answers receiving higher scores).

The research of Bartlett stressed the commonalities of the thinking process among subjects; the research of Guilford stressed a factor analytic type of approach to discover the components of

intelligence. Also working in the 1950's was a third group of researchers, Witkin et al. (1954), who were particularly concerned with the differences in the cognitive processes of learners. Witkin, who is known as the father of cognitive style, identified a field dependence-independence perceptual dimension. He found that field independent persons were analytical and separated elements from their background. In contrast, field dependent persons approached situations in global ways; that is, they saw the total situation, perhaps to the extent that they were not able to separate themselves from their environment. (Guilford, 1980, viewed field independence as a matter of flexibility, not analysis.) Witkin identified four essential characteristics of cognitive style (Witkin et al 1977). First, cognitive style is concerned with process, not content. It refers to individual differences in perceiving, thinking, solving problems, learning or relating to others. Secondly, cognitive style is a pervasive dimension that includes both cognition and elements of what is generally called "personality". Thirdly, cognitive styles are stable over time but not unchangeable. Lastly, cognitive styles can be thought of as being bipolar in that unlike most tests more (a higher score) is not necessarily better. The utility of one's cognitive style must be judged according to its suitability to accomplish the task.

The relationship between cognitive style and thinking processes was also evident in the work of Schroder, Driver and Streufert (1967) who viewed one's personal orientation as a filter through which one selects certain kinds of information from one's environment. This is the content variable. Then these items of information are combined in different ways depending on one's cognitive style. In the view of

Schroder et al. people differ in the number of categories or dimensions they perceive when categorizing concepts and integrating these into new concepts. His semi-projective tests included a test in which subjects were given a list of slightly incongruous adjectives and were asked to write a paragraph describing a person with those characteristics. They were then rated on the degree of integrative complexity indicated.

McKenny and Keen (1974) developed a model of cognitive style consisting of two dimensions: a preceptive-receptive information gathering continuum and a systematic-intuitive information evaluation continuum. They theorized that the reason why one develops a characteristic cognitive style is to ease "cognitive strain". One develops a mental set with which one feels comfortable. When information gathering one rejects some data and summarizes and categorizes the rest. Preceptive individuals use pre-established concepts to filter data and catalog it. They look for deviations from and conformities with their expectations. Receptive individuals are more sensitive to the stimulus itself and derive the attributes of the information from direct examination of the details of the situation. That is, they tend to assimilate it in the raw form. The second dimension of their model is the systematic-intuitive information evaluation continuum. An individual may have a tendency to develop clear sequential plans or may have a tendency to develop ideas freely from data and to skip from part to whole (McKenny and Keen in Knaak, 1983). McKenny and Keen (1974) were successful in isolating 20 students from 107 MBA students whose test results indicated a distinct cognitive style. They reported that each group preferred different types of problems and also were most successful in solving different

kinds of problems.

Getzels and Jackson (1962) identified two basic cognitive or "intellective" modes. They theorized that one process represented intellectual acquisitiveness and conformity, the other intellectual inventiveness and innovation. They stated that these have been variously called "convergent thinking" and "divergent thinking" by Guilford, "defensiveness" and "openness" by Rogers, and "safety" and "growth" by Maslow. Hence, the researach by this author on the reading processes of more divergent and less divergent thinkers can be viewed as studying one aspect of cognitive style.

There has been little research relating cognitive style to reading. Pitts and Thompson (1982) related four cognitive styles to reading comprehension. They tested students in grades two to four and found that reading comprehension was positively related to field independence (ability to locate a simple figure in a complex field), being reflective rather than impulsive when faced with uncertainty, the tendency to use broad rather than narrow categories for categorization and the ability to attend to relevant but ignore irrelevant stimuli.

Researchers have defined many different elements in cognitive style and do not agree on a definition. However, for most researchers it has both perceptual and intellectual components. Santostefano (1969) pictured cognitive style as the amount of organization of information available to the individual at the moment. Wachtel (1972) spoke of field independence as an ability first and a preference trait second. Guilford (1980) prefered the term "intellectual style" because for him "cognitive style" had a narrow interpretation. He viewed "intellectual style" as representing a profile of interest and

motivation within individuals. Whatever it is, it represents an individual's approach to cognition that is stable over time. It is his/her method of viewing and interpreting the world and affects many of his/her learning tasks.

Reading as an Interactive Process

For this study reading is viewed as an interactive process. From the text written by the author the reader selects cues which allow the connection of the text with the past experience of the reader, thereby giving meaning to the text. Rosenblatt (1978) pictures the reader as developing a tentative framework or guiding principle of organization and an arousal of expectations that influences the selection and synthesis of further responses. As more of the text is read and more past experiences are recalled, the interpretation is revised as necessary until the interpretation of the text is completed. The past experiences which aid in bringing meaning to the text also form a framework of reference for the reader and act as an aid in the long term retention (memory) of the text. The cues selected from the text not only depend on the past experiences of the reader but also depend on the present state and the present interests or preoccupations of the reader.

A model of the reading process which pictures the reader constructing or reconstructing meaning using both the text and his own past experience has been explicated by Fagan (1983a) in his Semantic Potential Interactive Process Model of Reading as shown in Figure 2. It is this model which provides the theoretical framework for this study. The reader's past experience includes knowledge of the world

from personal or vicarious experiences and knowledge of language including vocabulary, grammar and syntax. Also relating to past experience and affecting the reader's approach to the task is his/her concept of reading. The reader's attitude toward the task and the strategy used are also pertinent. The actual process used by the reader cannot be directly observed because reading is a covert cognitive process, but various products of reading such as oral recalls and answers to questions asked of the reader can be analyzed to determine the processes used by the reader to interpret the text.

The processes used by the reader are attending, analyzing, associating, synthesizing, inferring, predicting and monitoring. They are not regarded as being sequential but are interactive and interdependent. The reader attends (or pays attention) to the reading task and intends to reconstruct the author's meaning from the print. The print is analyzed into recognizable units for further processing. This visual information is associated with sound and/or meaning (word identification). These identified parts of the written discourse are synthesized into a meaningful whole by relating the parts to one another. Frequently the reader must "fill in the gaps" between the ideas the author has expressed by inferring other information necessary for the understanding of the passage. The reader also anticipates what the author is going to say and makes predictions as he/she reads. These predictions are either confirmed or disconfirmed as the reader monitors, using cues in the text or background knowledge. New predictions are made and confirmed as necessary.

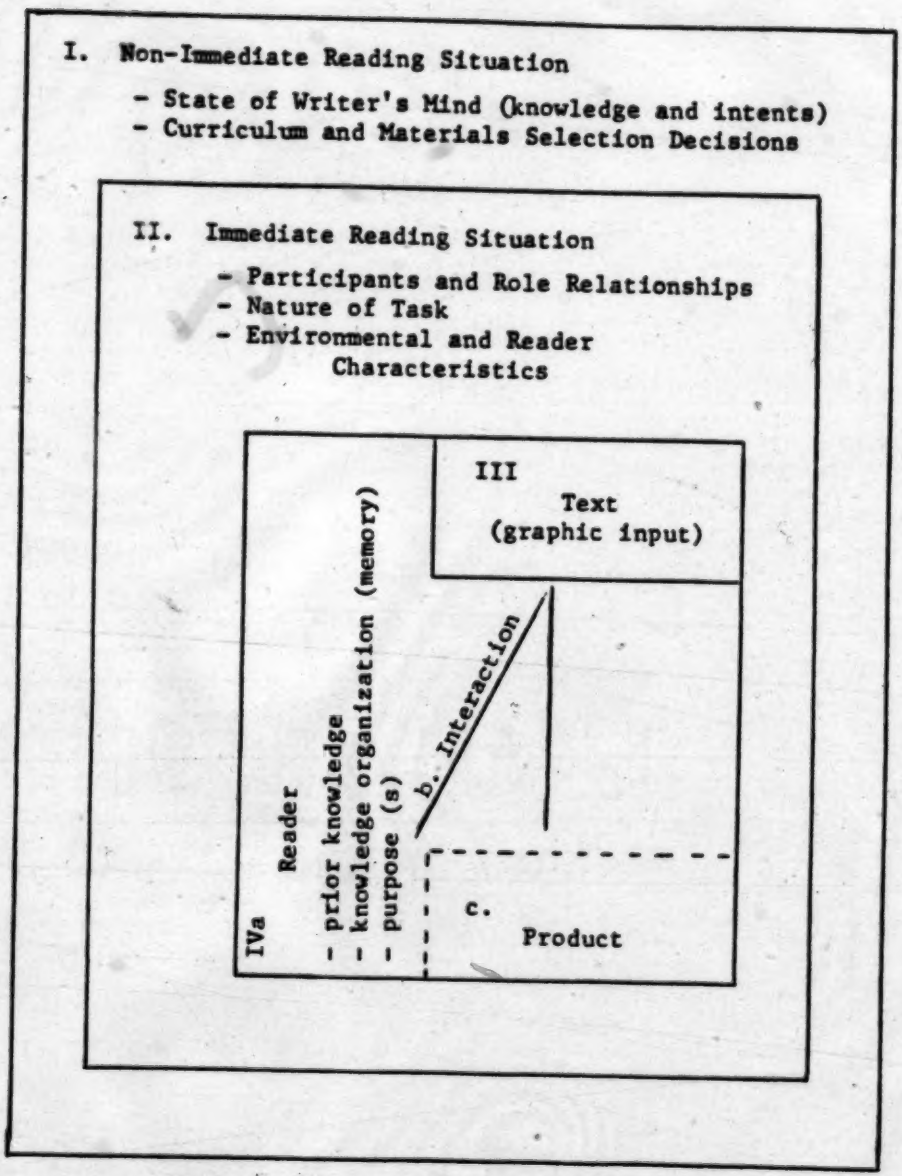

Figure 2 . General Components of the Semantic Potential Interactive Processes Model of Reading (Fagan, 1983a)

Reading and Divergent Thinking

Research as early as the late 1950's correlated academic success with some of the categories in Guilford's model. Schmadel (1960) examined the relationship of creativity of sixth grade pupils with their academic achievement. Creativity was assessed by measuring sensitivity to problems, conceptual foresight, ideational fluency and originality. She concluded that creative thinking abilities are important correlates of reading vocabulary and reading comprehension. Creative thinking abilities made a larger contribution to synthesis than to evaluation while age, sex, socioeconomic status and mental age made a greater contribution to evaluation. Conceptual foresight explained the most variance in the reading scores and was followed by originality, sensitivity to problems and ideational fluency. Harootunian (1966), using subjects from the seventh and eighth grade, also found that creative thinking abililty was significantly correlated with reading vocabulary and reading comprehension.

Later researchers have shown that this relationship is more complex than originally thought. Byrne, Feldhusen and Kane (1971), using a sample of grade six students, related divergent thinking ability to scores on cloze tests. Subjects who were high in associational fluency (the ability to rapidly produce words of similar meaning) performed significantly better on cloze tests, but high scores on expressional fluency (the ability to generate sentences given the first letter of each word) and flexibility (the ability to list ideas in a number of different categories) were not related to high scores on cloze tests. In another study Sullivan (1973) examined the relationship between critical reading and creative thinking. She

found that only two variables, general intelligence and arithmetic reasoning, contributed significantly to literal and critical reading at both the grade six and grade eight levels, while critical thinking and word fluency had small but significant correlations with reading only at the grade eight level.

Working with fourth and sixth grade students Hatcher and Felker (1974) found that both intelligence and divergent thinking variables were highly related with reading. Intelligence and flexibility were generally predictive of reading achievement. Their results indicated that the combination of convergent thinking, divergent thinking and self concept variables accounted for from 60% to 70% of the variance in reading achievement as measured by word knowledge and reading comprehension. However, they were unable to account for the remaining 30% to 40%.

Turner (1977) investigated the relationship between student performance on both divergent figural units and divergent semantic units and reading comprehension of fifth grade students. There was a significant relationship between high and low performance in the production of divergent semantic units and performance on the reading comprehension test (with the highly divergent being better comprehenders) but no significant relationship between the production of divergent figural units and performance on the reading comprehension test.

In an eight week study to determine whether creative thinking abilities could be enhanced for grade four pupils, Hicks (1980) found that there was a significant difference on inferential reading scores (p =.05) as measured by the Stanford Diagnostic Reading Test after eight weeks of instruction.

Although all studies have not found a significant correlation between reading comprehension and divergent thinking, enough research has indicated this relationship may exist to encourage its continued study. Most researchers who have studied this relationship in the past have examined only one product of reading comprehension, structured recall (answers to written questions). The measure has been a standardized reading test which defines reading as word knowledge and reading comprehension. Only Turner (1978), who used oral recall and miscue analysis, and Byrne et al. (1971) who used cloze measuurement procedures, employed other types of measures. However, they failed to draw interpretations regarding reading processes from their data.

Measures Used to Evaluate Reading

Oral recalls have frequently been used for gathering information about the mental process of reading comprehension. For some researchers analysis of the text was of prime importance (Fredericksen, 1975; Mandler and Johnson, 1977;, Kintsch and van Dijk, 1978, Tierney, Bridge and Cera, 1979). However, for Drum and Lantaff (1977) the focus was on the reader's production. They described the reading comprehension process as consisting of the integration of fragments in the text with the reader's generalized world knowledge. Drum and Lantaff compared the recall to the original text after dividing each into propositions. Each proposition from the recall was placed in one of five categories depending on its similarity to the original text. Fagan has modified and refined these categories (see Appendix C). His classification system consists of six categories

(two each for the processes of associating, synthesizing and inferring) plus an error category. His unit of analysis has been t-units or clauses. It is this system of protocol analysis which is used in this study to analyze oral recall data.

Royer, Hastings and Hook (1979) have developed a more structured technique to evaluate reading comprehension. This method was also dependent on the theoretical consideration of reading as a psychological process. Basic to the design of the measurement technique was that the linguistic message, the recipient's prior knowledge and the environmental context all interact to determine the environmental message (Royer and Cunningham, 1978; Kintsch and van Dijk, 1978; Smith 1971). Royer et al. (1979) believed that the "memorial representation" preserved the meaning of the message but not its surface structure. Readers were given a two-choice discrimination problem. When given a list of sentences they were asked whether the sentences were the same or meant the same as an original sentence or whether they were different in meaning or unrelated to an original sentence in the text. Using fourth and sixth graders reading passages at grade level, two levels below and two levels above, Royer found his method detected differences in performance of the readers at these varying levels of difficulty.

Fagan (1982) has utilized this sentence verification technique in conjunction with the classification system used for oral recall. The test consisted of a number of sentences which had been constructed so that the reader would engage in a certain reading process in order to correctly identify whether the test sentence was representative of a unit in the original text. He found that grade five students made significantly more inferences and fewer errors than grade three

students even though both were reading material appropriate to their level. Also, a significantly greater number of inferences were made by students when they read easier passages. Hence, this technique seems to be useful for differentiating students in terms of reading processes and was used in conjunction with analysis of oral recalls in the present study.

Summary

There have been several attempts to differentiate the cognitive style of learners (Witkin et al., 1954; Schroder et al., 1967; McKenny and Keen, 1974; Getzels and Jackson, 1962). Their success would lead one to believe that there are basic differences between divergent and convergent thinkers which may affect the way people read. However, in the past studies on reading and divergent thinking have had both positive and negative results when attempting to relate scores on measures of divergent thinking with those on reading achievement. Most researchers have used structured recall (questions) and they did not attempt to differentiate the processes of the readers. Even Turner (1978), who used oral recall and miscue analysis, and Byrne et al. (1971), who used a cloze technique, did not report process results.

The Semantic Potential Interactive Process Model of Reading (Fagan, 1983) provides a theoretical framework for interpreting some of the products of the reading process in terms of the processes used by the reader. Reading is viewed as an interactive and constructive process. The author's message, the reader's past experiences and the environmental context in which the message is received all interact to

determine the interpretation of the message.

Building on research by Drum and Lantaff (1977), Fagan (1983) has developed a system to categorize the recall protocols of readers. The clauses of the recall are classified according to the process used by the reader. Fagan (1982) has also developed a second and more structured task for assessing reading processes, the sentence verification task. This task is based on the same categories as the protocol analysis. This study utilizes the above measurement devices and focuses on the reading processes of divergent and less divergent readers.

CHAPTER III

DESIGN OF THE STUDY

This chapter includes a description of the experimental design and a review of the method used to select the sample. The instruments used in the study and the procedures used to gather the data are discussed. The method used to code the data is explained and the purpose and results of the pilot study are presented. Finally, the statistical analysis of the data is discussed.

Selection of the Sample

The 73 grade six students tested for divergent thinking ability were chosen from seven schools, most of which served predominately middle and upper middle class neighborhoods in a large urban centre. They had tested above the seventy-fifth percentile in reading comprehension in May of their grade five year using a reading test developed by the school system which measures a range of reading comprehension skills including synthesizing information, generalizing and making inferences, as well as remembering exact information found in the text of the reading selection. All spoke English as a first language. All had some instruction in a second language but none were in second language immersion programs. Each student's ability to comprehend written discourse was confirmed by his/her teacher. All parents were required to sign and return a form which signified their consent for their child to participate in the study.

The ability of each of the 73 students to think divergently was

measured by the Torrance Test for Creative Thinking (Verbal) Form A. From this group of 73 students the 20 students who obtained the lowest scores and the 20 students who obtained the highest scores were chosen to form the two sub-groups of the sample group. Scores on the Torrance test ranged from 36 to 84 in the low group and from 113 to 145 in the high group. The average score of the low group was 65.9 and of the high group 124.8.

To reduce the possibility that the intelligence of the students was a confounding variable, the researcher had initially planned to equate both groups so that their verbal intelligence as measured by the Canadian Test of Cognitive Abilities would not be significantly different in a one-way analysis of variance. However, the 20 who scored the lowest on divergent thinking had an average of 122.6 on the verbal section of this test of intelligence (with a range of 99 to 140) and the 20 who scored the highest had an average verbal score of 122.2 (with a range of 107 to 141) so it was not necessarry to alter the composition of either group.

To insure that IQ had no influence on the results, correlations were computed between IQ and reading scores, Torrance scores and the dependent variables. IQ was not significantly correlated with reading comprehension ($r = .32$, $p = .08$), with Torrance scores ($r = -.37$, $p = .06$) or with most of the recall and sentence verification variables. IQ was significantly related only to the combined error category ($r = -.52$, $p = .01$) on the recalls, one of the error categories on the sentence verification task , D-, ($p = .52$, $r = .01$) and one other sentence verification variable, E+, ($r = .42$. $p = .03$). Hence it would appear that IQ was not a confounding variable in the comparison between groups in this study.

Table 1

Background Information on High Divergent Thinking Subjects

Subject	Sex	Torrance Score	Verbal I.Q.	Reading Comprehension
1	M	145	115	80
2	F	139	109	80
3	F	135	116	80
4	F	132	130	95
5	F	129	124	80
6	F	129	117	98
7	F	127	121	86
8	F	125	125	75
9	F	125	137	91
10	M	124	107	94
11	F	124	122	91
12	F	124	116	80
13	F	123	141	91
14	F	120	124	95
15	F	120	116	97
16	F	120	110	80
17	F	115	134	95
18	F	114	133	98
19	M	113	125	83
20	M	113	122	99
Mean Score		124.8	122.2	88.4

Table 2

Background Information on Low Divergent Thinking Subjects

Subject	Sex	Torrance Score	Verbal I.Q.	Reading Comprehension
21	M	84	106	89
22	F	83	121	94
23	M	82	137	86
24	F	79	140	80
25	M	79	121	80
26	M	77	124	95
27	F	76	110	86
28	M	72	133	97
29	M	71	140	98
30	M	70	124	89
31	M	70	118	83
32	M	69	99	83
33	M	65	124	80
34	M	62	123	99
35	F	57	110	99
36	M	56	120	94
37	F	52	105	77
38	M	40	138	95
39	M	37	128	83
40	F	36	131	95
Mean Score		65.9	122.6	89.1

It was also thought, although all readers in the sample were good readers as they scored above the seventy-fifth percentile on reading comprehension, that the average score for one group could be several points higher than the average for the other group. This, however, was not found to be true. The average of the reading comprehension scores for the low divergent thinking group was 89.1; the average for the high divergent thinking group was 88.4.

No attempt was made to balance the two groups of the sample for male and female participants. At the grade six level the divergent thinking good readers were predominantly female. Sixteen of the sample group of 20 were girls and only four were boys. However, the low divergent thinking group was predominantly male, with 14 boys and six girls. In tables 1 and 2 a summary of IQ, reading comprehension and Torrance scores as well as sexual status is presented for each subject.

Testing Instruments

Tests Used for the Selection of the Sample

The results of three standardized tests were used in this study to assist in forming the sample: the Edmonton Public Schools' Elementary Reading Test (comprehension section), the Canadian Cognitive Abilities Test , the Torrance Test of Creative Thinking (Verbal). The Canadian Cognitive Abilities Test was used to obtain a score for verbal intelligence. The form used from grades three to nine was normed in 1973 using 139 schools from across Canada in which

English was the language of instruction. The verbal battery of the test consists of items in each of the following areas: vocabulary, sentence completion, verbal classification and verbal analogies. Reliability and validity data are not available from the publisher. This intelligence test was administered by the classroom teacher in February of the students' grade six year and the results were obtained from the students' records.

The Edmonton Public Schools' Elementary Reading Test was constructed from questions developed by teachers in the school system and from materials copyrighted by the Houghton Mifflin Company and Thomas Nelson and Sons (Canada) Limited. The comprehension section contains 90 questions designed to assess vocabulary and literal, inferential and critical comprehension. Final norms were established in 1979 after administration of the test to all grade five students in the school system in May 1979. The results were tested for reliability using the KR20 formula. The reliability of the total test (comprehension and decoding) was found to be 0.949. Content validity was found by having groups of teachers analyze the test items. This reading test was administered to the students in May of their grade five year. Because of the possibility that this information was inaccurate or outdated, the fact that each student in the sample was a good reader was confirmed by the student's classroom teacher.

The Torrance Test of Creative Thinking (Verbal) Form A was used to identify 20 high divergent thinking and 20 low divergent thinking students to comprise the sample for the study. It was developed in the nine years preceeding its publication in 1966 by E. Paul Torrance and his colleagues. A validity rating of 12 out of a possible 15 points has been given to this test by the Center for the Study of

Evaluation, Research for Better Schools Incorporated (CSE-RBS) Test Evaluation Services (1972). A total of five points is given for empirical validity, the amount of empirical evidence that would give an administrator confidence in its usage. Criteria used to judge this are test utilization in experimentation, number and quantity of content analyses, correlation with other tests and ability to discriminate between groups. A total of 10 points is given for construct validity. When awarding points in this category the evaluator judges how well the test measures, for the age or level specified, the cognitive aspect it was designed to measure for both breadth and depth.

The Torrance test was administered by the investigator to groups of students in their own schools in accordance with procedures outlined in the administration manual. Three of the seven questions were used: product improvement (of a stuffed toy elephant), ususual uses (of cardboard boxes) and "just suppose" (If clouds had strings hanging from them down to earth what would be the consequences?). The other four questions were not used for two reasons: economy of time, as at least 60 students were to be tested, and the fear that the fairy tale character pictured for the first three questions would produce a negative reaction in some grade six students. It was thought that the three questions chosen provided a variety of tasks for which divergent thinking could be used. For this paper and pencil test each of the questions was timed, total administration time being 25 minutes.

As outlined in the manual, three components of verbal divergent thinking were tabulated: fluency (total number of scorable responses), flexibility (number of categories used by the student), and originality (with infrequent or ususual answers receiving more

points). The Torrance score consists of the sum of the scores on the three sections. In total 73 students were given this test and the highest 20 and lowest 20 comprised the sample for this study.

Tests Used With the Sample Population

Reading Selection

Students read silently a 500 word narrative selection, Lester the Lister (Nelson, 1980, See Appendix A). The selection is found in the grade six level of the Nelson Evaluation Program and calculations based on the Fry Readability Scale (1972) also place this selection at the same reading level. Narrative was chosen because grade six students are most familiar with this genre. Following the reading each student was asked for an oral recall and performed a sentence verification task.

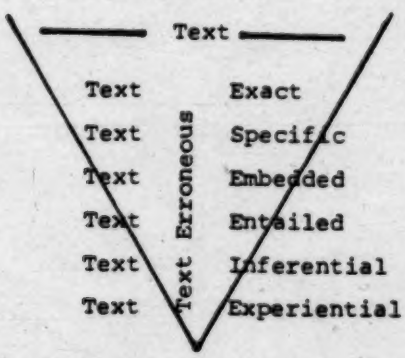

Figure 3. Schematic relationship showing degree to which recall categories resemble text (Fagan, 1983a, p. 7-22).

Categories for Analysis

The same category system was used both to code the clauses from the recalls and to develop sentences for the verification task. These were Fagan's (1983a) revision of Drum and Lantaff's (1977) categories and represent the degree of text occurring in the recall. This relationship is shown in Figure 3.

The text exact category (A) represents an exact duplication of the text in the recall but items in each successive category represent progressively more input from the reader's experience and less input from the text. Fagan (1983b) defines his recall categories as follows:

A. Text Exact: This category includes information from the text in its exact form or with minimal variations, such as substituting "a" for "the". The recall data suggest that the reader has made an "exact association" with input data.

B. Text Specific: In this category is placed information that has specific references within a single text unit. The information within the unit may have been reordered or transformed with different lexical items and suggests the reader is associating - transforming.

C. Text Embedded: The information in this category is also specific to the text but the unit of recall includes information from more than one unit of the text, that is, data from one unit are embedded in another in a fairly specific manner. The reader may be considered to be synthesizing - embedding.

D. Text Entailed: The retrieved information consists of a superordinate statement that subsumes information from more than one unit of the text. It may be assumed that at the time of comprehending, the reader "constructed" information or that the reader "reconstructed" information at the time of recall. The reader may be synthesizing - constructing.

E. Text Inferential: The information assigned to this category has been added by the reader to fill in gaps in the text data and is derived from knowledge schemas of world events. Unlike synthesizing - constructing, inferring does not generate a new framework or construct for the existing text data but bridges a gap between data as presented by the author.

F. Text Experiential: Like inferential data the information assigned to this category, while related to the text, is generated from the reader's schema. Unlike inferential data, experiential data are not constrained by the text and may be idiosyncratic to the reader's experiences; that is, the reader is embellishing or elaborating. The processing may be labelled associating - elaborating.

G. Text Erroneous: This category contains information that is erroneous in the sense that it contradicts or is inconsistent with text data or is inaccurate in terms of world knowledge.

Sentence Verification Technique

Following the oral recall each student performed a sentence verification task which was designed by Fagan (1982) based on a method devised by Royer (1979). The test consisted of 18 sentences, two items representing correct items from each of Fagan's six comprehension categories, from A to F, and one sentence from each category which represented an incorrect item. The student was asked to identify those "statements which were true in terms of the story". As the sentence verification technique was a relatively new method of evaluating reading processes, a comparison of the scores resulting from this technique with the scores from the oral recalls was of interest.

Administration of the Tests

Each student in the sample was tested individually in a quiet room in his/her school in early May. The student was given the following directions:

> I have a story I want you to read carefully. It is a short story about a page long but it is on two pages with lots of pictures. After you have read the story, I want you to tell me everything you can remember about it. Then I want to ask you some questions. You can take as much time as you like.

Each student read the story, gave an oral recall (which was tape

recorded) and then performed the sentence verification task. (See Appendix E for a copy of this test.) The first page of this task contained the directions and two sample questions which were done orally before the student began the test. Then the student circled the number of each sentence that was true in terms of the story. The student was then asked two questions:

> As you were reading the story, did you think of anything else but the story? That is, did your mind wander to something perhaps connected to the story but in your own past experience? [and] Did you use any particular way to remember the story? That is, did you use any special method to help you recall any part of the story?

The answers to these questions were also tape recorded. For most students the total testing time was eleven or twelve minutes.

The Pilot Study

The purpose of the pilot study was to make sure that the directions were understandable, that the items in the sentence verification technique test were satisfactory and that the reading selection would be met with a favorable response by the students in the sample. In late April five students whose reading comprehension score was between the seventieth and the seventy-fifth percentile read the narrative selection, gave an oral recall and performed the sentence verification task. They confirmed that there was no problem with the directions and sentence verification tasks and approved of the choice of story. All were cautioned not to reveal anything about the study to their classmates.

Coding the Data

The oral recalls were tape recorded and transcribed. Before analysis irrelevant data in the recalls were eliminated. These were of two types: mazes (repetitions, corrections, interjections and audible noise) and recall conventions (which were usually broad generalizations and appeared to be made in an attempt to cover-up lack of specific knowledge). The remaining recall data were analyzed by dividing them into clausal units and categorizing each clause according to Fagan's classification system. An inter-rater reliability of .94 was obtained on the basis of six recalls. The Arrington formula as explained in Feifel and Lorge (1950) was used.

i.e.

$$\frac{2 \times \text{agreements}}{(2 \times \text{agreements}) + \text{disagreements}}$$

For a more detailed explanation regarding elimination of irrelevant data and the choice of the clause as the unit of analysis see Appendix B. Appendix C gives a description of Fagan's recall categories. An example of an analyzed recall protocol is found in Appendix D.

A minor change in Fagan's classification system was made when scoring the error clauses. In order to make a direct comparison between the recall data and the sentence verification data there was an attempt to classify the errors made in the recalls as to which type of error was made, that is, categories A minus to F minus were created. However, it was frequently difficult to determine the source of the misinformation and therefore the category into which the error

should be placed. As the purpose of classifying a clause in a category was to reveal the process used by the reader, the category was determined by the source of the error, not by the category into which the clause would have been placed if it had been correct. For example, if a student recalled "Lester listed what kind of bread he was going to eat such as whole wheat or vitamin enriched white", the clause was classified in Category C because it was correct and combined information by embedding from more than one clause in the original text. But if he substituted rye bread for white bread it was classified in Category B minus because the error was due to error in recall of a text specific type. However, before analysis all these error categories were combined into one error category, G, because the number in each was so small that statistically reliable conclusions could not be drawn using the small error categories.

Statistical Analysis of the Data

Because the recalls of the high divergent thinkers contained over 20 per cent more clauses than the recalls of the less divergent thinkers, the proportion of recalls in each category was calculated for comparison purposes. (The 20 high divergent students recalled a total of 501 clauses; the 20 low divergent students recalled a total of 391 clauses.) For the sentence verification task the negative and positive items for each category from text exact to text experiential were combined to make a possible category size of three, as this was statistically more reliable. Also the results from the text exact and text specific categories were combined for the sentence verification task because they both measure the associating process, and in the

text exact category the two groups differed by only one point (49 versus 50). The two items from each positive category required the recognition by the reader that the item was the same or meant the same as the text or was an extension of the meaning of the text and the one item from the negative category required the reader to recognize that the item was different from any item in the text. Correctly recognizing items in each category resulted in a possible three marks for the subject.

A Hotelling multivariate test of significance was run for both the recall and the sentence verification task data to determine if the performance of the two groups of students was significantly different. Anova analysis compared individual categories for both the recall and sentence verification tasks. Pearson correlation coefficients were computed between the results from all of the following: Torrance Test Of Creative Thinking (Verbal), Edmonton Public Schools' Elementary Reading Test (Comprehension Section), Canadian Test of Cognitive Abilities , the student recalls and the sentence verification recognition task.

Summary

The sample for the study was comprised of a total of forty students, all of whom scored at the seventy-fifth percentile or higher in reading comprehension. Groups were matched for I.Q. level. Twenty readers were low in divergent thinking ability and 20 were high. The independent variable was the divergent thinking ability of grade six students. The dependent variables were (1) the type of recall given and (2) the performance on the sentence verification task.

The Torrance Test of Creative Thinking (Verbal) was used as a measure to choose the high and low divergent thinkers for the sample. Each subject read a narrative selection of 500 words and then was tested for reading comprehension. The reading processes of the two groups were compared using two products of the reading process: oral recalls and the sentence verification task. The sentences for the sentence verification task were constructed using Fagan's comprehension categories and these categories were also used to analyze the oral recalls of the students. Students were also asked two questions relating to their reading processes.

A multivariate technique (Hotelling) was chosen to compare the oral recalls and the sentence verification tasks of the high divergent thinkers with those of the low divergent thinkers. Anova analysis compared individual categories. Pearson correlation coefficients were also run to determine relationships among the dependent and independent variables.

CHAPTER IV

FINDINGS OF THE STUDY

This chapter reports the findings of the study in two sections. In the first section each hypothesis is restated from chapter one and the statistical data which supports or rejects the hypothesis is presented. A statement of rejection or non-rejection is given. A probability level of .05 was chosen as the degree of confidence necessary for acceptance or rejection of the hypothesis when analyzing the data. A discussion of both hypotheses follows. The second section presents the descriptive data. The chapter concludes with a summary of the findings.

Statistical Data

Hypothesis 1

> There will be no significant difference in the reading processes of good sixth grade readers who are high in verbal divergent thinking ability from those who are low in verbal divergent thinking ability as inferred from the oral recalls.

Findings

A Hotelling's multivariate analysis compared the mean of the proportion of clauses in the recall categories for the two groups. Comparing groups across combined categories gave an F ratio of 1.51 (df= 6,33) for which $p > .05$. On the basis of these results it was concluded that there was no significant difference between the means of the recalls of the high and low divergent thinkers. Therefore the

null hypothesis was not rejected.

Any comparison of individual categories is questionable because there was no significant difference when the two groups were compared on all categories simultaneously. However, when each category was analyzed separately using an anova and the correlation between categories was ignored, the difference in the mean proportion of statements in the text experiential category was significant at the .05 level. (See Table 3.) The text exact category was omitted from the analysis because it was too small to be statistically reliable and the number of items in this category was similar for high and low divergent thinkers (nine and seven items respectively).

Table 3

Anova Analysis of Recall Categories for High and Low Divergent Thinkers

Category	F	Sig. of F
Text specific	1.80	.19
Text embedded	.15	.70
Text entailed	.89	.35
Text inferential	.07	.80
Text experiential	5.56	.02*
Text erroneous	.87	.36

* $p < .05$.

The similarity between groups can be seen by examining the means and standard deviation scores in Table 4. The proportion of recalls

in most categories was similar for the high and low divergent thinkers. There were relatively small proportions of recalls in all categories except the text specific category, in which approximately half of the recalls were placed. The largest differences between groups were in this category (.48 for the high divergent group and .53 for the low divergent group) and in the text experiential category where the .05 difference was reversed (.10 for the high divergent and .05 for the low divergent). The standard deviations, which were larger for the high divergent group, show that for this task there is more similarity within low divergent thinkers than high divergent thinkers.

Table 4

Means and Standard Deviations for Recall Task Categories for High and Low Divergent Thinkers

	High Divergent		Low Divergent	
Category	Mean	SD	Mean	SD
Text exact	.02	.03	.02	.03
Text specific	.48	.13	.53	.10
Text embedded	.07	.04	.06	.05
Text entailed	.12	.10	.15	.08
Text inferential	.16	.09	.16	.08
Text experiential	.10	.08	.05	.05
Text erroneous	.05	.05	.03	.04

To obtain further information regarding the relationship of

divergent thinking with oral recall data, Pearson correlation coefficients were calculated between the scores on the Torrance Test of Creative Thinking (Verbal) and the scores on the recall categories. These correlation coefficients are presented in Table 5. Again, there

Table 5

Pearson Correlation Coefficients for Torrance Scores and Recall Categories (Combined Groups)

Recall Category	Correlation Coefficient	P
Text exact	-.03	.42
Text specific	-.27	.05*
Text embedded	.18	.14
Text entailed	-.20	.11
Text inferential	.10	.27
Text experiential	.40	.01*
Text erroneous	.15	.18

* p = or <.05

was not a significant relationship of most recall categories to divergent thinking, confirming the results of the Hotelling's analysis. However, the correlation of Torrance scores to the proportion of recall units in the text experiential category was significant (consistent with the anova data). The fact that this correlation was positive indicates that the more divergent thinkers produced a greater percentage of text experiential recall units than did the less divergent thinkers. Also evident was that divergent

thinking was negatively related to the percentage of clauses in the text exact, text specific, and text entailed categories, although this only reached significance for the text specific category.

Hypothesis 2

> There will be no significant difference in the reading processes of good sixth grade readers who are high in verbal divergent thinking ability from those who are low in verbal divergent thinking ability as inferred from the sentence verification task.

Findings

A Hotelling's multivariate analysis compared the means of the sentence verification categories for the high divergent and low divergent groups. Comparing groups across all categories gave an F ratio of 1.78 (df=5,34) for which $p > .05$. There was no significant difference between the means on the sentence verification task for the high and low divergent thinkers and the null hypothesis was not rejected.

Any comparison of individual items within the group is questionable because there was no significant difference when the two groups were compared on all categories simultaneously. However, when each category was sampled separately and the correlation between categories was ignored, there was a significant difference between the sentence verification tasks of high and low divergent thinking groups in the text inferential category. (See table 6.)

Examination of the means and standard deviations for the sentence verification task showed that the less divergent thinkers generally received slightly higher scores on this task although there was little difference between groups. (See table 7.) The largest difference in means was for the text inferential category, in which

high divergent thinkers obtained higher scores (1.55 as compared with 1.10).

Table 6

Anova Analysis of Categories for Sentence Verification Task for High and Low Divergent Thinkers

Category	F	Sig. of F
Text exact & text specific	.22	.64
Text embedded	.00	1.00
Text entailed	1.57	.22
Text inferential	5.27	.03*
Text experiential	.50	.49

* $p < .05$

Pearson correlation coefficients comparing scores on the Torrance test and the means for the sentence verification task categories were calculated to provide further information on the relationship between divergent thinking and performance on the sentence verification task. Divergent thinking was not significantly related to sentence verification scores on all except one category (text entailed), generally confirming the results of the Hotelling's analysis. (See Table 8.) However, insignificant negative correlations of Torrance scores with sentence verification task results for eight of the 12

Table 7

Means and Standard Deviations for Sentence Verification Task Categories for High and Low Divergent Thinkers

		High Divergent		Low Divergent	
Category		Mean	SD	Mean	SD
Text exact:	A+	1.50	.51	1.45	.60
	A-	1.00	.00	1.00	.00
Text specific:	B+	1.60	.60	1.75	.44
	B-	.95	.22	1.00	.00
Text embedded:	C+	1.70	.57	1.85	.37
	C-	.80	.41	.65	.49
Text entailed:	D+	1.15	.75	1.35	.49
	D-	.90	.31	.95	.22
Text inferential:	E+	1.55	.69	1.10	.55
	E-	1.00	.00	1.00	.00
Text experiential:	F+	1.05	.83	1.25	.97
	F-	.95	.22	1.00	.00
Mean total score		14.15		14.30	

Table 8

Pearson Correlation Coefficients for Torrance Scores and Sentence Verification Task Categories (Combined Groups)

Category		Correlation Coefficient	P
Text exact:	A+	-.05	.39
	A-	—	—
Text specific:	B+	-.13	.20
	B-	-.09	.29
Text embedded:	C+	-.19	.12
	C-	.14	.19
Text entailed:	D+	-.29	.04*
	D-	-.12	.24
Text inferential:	E+	.21	.10
	E-	—	—
Text experiential:	F+	-.11	.26
	F-	-.12	.22

Note .—Could not compute because all subjects obtained the correct answer.
* $p < .05$

categories reflects the somewhat better performance of less divergent as compared to more divergent thinkers on this task. The less divergent the student the better able he/she was to do the sentence verification task but this relationship reached significance only on the text entailed category.

Summary and Discussion of Hypotheses

Multivariate analysis of both the recall and sentence verification data when comparing all categories simultaneously supported the null hypotheses; that is, there was no significant difference in the reading processes of high divergent and low divergent thinkers. However, when the means of individual categories were considered for the recall data, the difference between high and low divergent thinkers in the text experiential category was significant. High divergent thinking readers gave a greater percentage of recall clauses in the text experiential category than did low divergent readers. This was shown by an anova analysis ($F = 5.56$, $df = 1,38$, $p = .02$) and the Pearson correlation coefficient ($r = .40$, $p = .01$). There was also a significant negative correlation between Torrance scores and the text specific category. Low divergent readers recalled a greater percentage of clauses that were almost the same as those in the written text.

On the the sentence verification task there was no significant difference between high and low divergent thinkers in the text experiential category but the anova analysis revealed that there was a significant difference in the text inferential category ($F = 5.27$, $df = 1,38$, $p = .03$). The mean for the high divergent group was larger

than that for the low divergent group on the text inferential category (1.55 for the high divergent as compared to 1.10 for the low divergent). However, when Pearson correlation coefficients were used to relate Torrance results with scores on the sentence verification task categories, the only category for which there was a significant relationship was the text entailed category ($r = -.29$, $p = .04$) Like most other correlations of sentence verification categories with Torrance scores, the relationship was negative.

Generally, the results on the recall and sentence verification tasks indicate that while there was considerable similarity in reading processes of high divergent and low divergent thinkers, there were also some differences. Both groups produced much more recall information in the text specific category than in any other, indicating that readers were associating - transforming about half the time when they were reading. Clarke's (1981) able sixth grade readers also produced over 46.6 per cent of recalls in this category. The information in the text specific category has specific reference to the text but has been transformed by a reordering of information or substitution of lexical items. That is, readers are putting the author's statement in their own words. This finding may reflect the type of directions given the readers before the reading task. The students may have considered that what was requested was a recall of the literal meaning of as much of the text as they could remember. Clarke also hypothesized that his directions (similar to those used in this study) affected the type of recall given by grade six students. However, in this text specific category there was a significant negative relationship to Torrance scores. Less divergent thinkers recalled a greater proportion of clauses in the text specific

category.

Differences in reading processes between groups appeared in the text experiential, inferential and entailed categories. The fact that divergent readers recalled more clauses in the text experiential category suggests that this type of reader was more frequently associating his/her past experiences to the text even when these connections were not necessary to "fill in the gaps" of the text. This type of information is not constrained by the text and suggests a cognitive style in which the reader frequently associates the written text with past experience. The person with this cognitive style is more comfortable elaborating and embellishing than is the less divergent thinker. When one considers the nature of the Torrance Test of Creative Thinking (Verbal) one might expect a high score on the Torrance test to be correlated with a high score on the text experiential category. The questions on the Torrance test require a highly developed ability to associate ideas from one's past with the focal idea of the designated task. Also, the marking of the Torrance test gives more points for unusual answers and almost by definition these are ideas which are not as directly connected with the task.

While the results on the sentence verification task did not support the results on the recall task for the text experiential category, there was again evidence of greater reliance on past experience by high than low divergent thinkers. The anova analysis for the sentence verification task showed that high divergent thinkers had significantly higher scores on the text inferential category. They were better able to make inferences to "fill in the gaps" by drawing on past experiences in light of the information in the text. This is a synthesizing - constructing type of activity which requires

that one draw on past experiences and relate them to the text being read. Overall then, results suggest greater use of background knowledge, both for elaboration and to "fill gaps" by the high divergent as compared to the low divergent readers.

While the recall data showed that high divergent students recalled a greater proportion of clauses in the text experiential category than low divergent thinkers, data from the sentence verification task showed that low divergent readers could recognize a text experiential statement when they saw it as well as the high divergent thinkers. Thus it appears that high divergent students were associating - elaborating as they read or as they recalled but low divergent students were capable of associating - elaborating when they were presented with a structured task and requested to do so.

Correlation data showed that the only significant relationship between Torrance scores and sentence verification category mean scores was a negative relationship on the text entailed category. This may reflect the more convergent nature of this synthesis task. Readers were required to subsume text information from different parts of the text under a superordinate statement and the number of appropriate superordinate statements was extremely limited. This process of synthesizing and reconstructing was a task in which convergent thinkers were more likely to succeed.

Overall, results comparing the two groups were similar as there was no significant difference on the two measurement techniques when all categories were compared simultaneously. Hence, both techniques may be global measures of reading processes, but some discrepancies in results on specific categories across the two tasks suggests that these tasks may not always be measuring the same thing when specific

processes are involved. In order to obtain further information on the relationship between performance on the sentence verification and recall tasks for each of the categories, Pearson correlation coefficients were run. As can be seen from Table 9, there were few significant relationships. Only for the E, or text inferential, category was there a positive correlation between categories which were identically labelled and attempted to measure the same reading process.

Table 9

Pearson Correlation Coefficients Comparing Mean Scores for Recall and Sentence Verification Categories

Sentence Verification Category (+ & -)	Recall Category					
	A+	B+	C+	D+	E+	F+
A	-.06 (.36)					
B	.16 (.16)	.11 (.25)				
C	.04 (.41)	.23 (.07)	-.28 (.04*)			
D	-.09 (.29)	.28 (.04*)	-.22 (.09)	.22 (.08)		
E	-.01 (.47)	-.16 (.16)	-.33 (.02*)	.31 (.03*)	.27 (.04*)	
F	.13 (.21)	.09 (.29)	.04 (.39)	- .09 (.29)	-.25 (.06)	.01 (.47)

( ) indicates p . * $p < .05$.
Note . A: text exact, B: text specific, C: text embedded, D: text entailed, E: text inferential, F: text experiential.

Hence, specific categories on the sentence verification and recall tasks did not appear to measure the same variables in most categories or if they did there were other confounding factors which so greatly influenced the results that these similarities were overshadowed. The selection of high and low divergent thinkers in this study may have been such a confounding factor. Recalling was an open type of task in which divergent thinkers could be expected to excell. The recalls of highly divergent students were on the average one-fifth longer, showing that these readers were more comfortable performing this type of task. The sentence verification task, for which there was a negative correlation of most categories with Torrance scores, was so structured that only one answer was appropriate. This is by definition a convergent task. The text entailed category, for which there was a significant difference between high divergent and low divergent groups (and low divergent students made significantly higher scores) may be a particularly convergent type of task.

It would appear then, that some of the discrepancies in results on this study were related to the nature of the test instrument. Some test devices require a divergent approach and some a convergent approach to the task. This may also account for the inconsistency of the findings in the literature. A significant relationship between reading comprehension and divergent or creative thinking was found by Schmadel (1960), Hatcher and Felker (1974), Turner (1977) and Hicks (1980), but Sullivan (1973) found that literal and critical reading were not related to critical thinking and word fluency at the grade six level, although there was a small significant correlation at the grade eight level. Possibly Sullivan's literal and critical reading

did not include inference as an item to be tested and this is the area in which divergent thinkers would excel.

While differences between measuring instruments is probably an important factor in results in the study, there could also be problems inherent in both measuring devices. The recall task might not be finely enough tuned as a measurement tool to have differentiated well between the two groups of readers studied. The sentence verification task could be improved in reliability by having more sentences representing the categories studied. This would require a longer reading selection.

Descriptive Data

In order to obtain further information regarding reading processes, after each reader had given an oral recall and completed the sentence verification task he/she was asked two questions:

Question 1

> As you were reading the story did you think of anything else but the story? That is, did your mind wander to perhaps something connected to the story but in your own past experience?

Replies

The answers were transcribed and categorized according to the nature of the approach used. The results are tabulated in Table 10. Fifteen of the high divergent thinkers and six of the low divergent thinkers indicated that they had recalled past experiences. Six responses of the first group and two of the second were classified as "associating only". Most frequently readers associated seeing their mother write lists or their own past list writing experiences such as

those paraphrased in the following excerpts. Subjects one to 20 were high divergent and subjects 21 to 40 were low divergent.

Subject 3: My Mom and Dad make lists - usually what to do 'cause they work during the day. In one class we made lists of who were our best friends and favorite foods.

Subject 11: I thought of my Mom making grocery lists. His mom made lists so she didn't forget things and I do the same thing except I write little notes.

Subject 13: I thought about my mother making the same kind of lists, grocery and dry cleaner lists. I also thought about her lists on the refrigerator, in her pocket and in her desk. I wondered what I would put on my breakfast lists if I made them.

Subject 9: I was reminded of the comic strips on my mom's refrigerator.

Subject 22: I'm always late for school because I take my time so I thought about that.

Responses of five high divergent readers and three low divergent readers were classified as involving an analytical - critical approach. Most frequently they were passing judgment on the story, the character in the story or on the practice of making lists.

Subject 6: I kind of thought it was a little bit dumb. It was a little bit unrealistic because there might be some people who like lists so much that they do a whole bunch of lists but I don't really think there is somebody who would do that so much that they miss everything.

Subject 14: When I collect some rocks or something I end up getting too many and I have to get rid of some of them. And it's really not worth it.

Subject 17: Oh, just that I think that his lists got quite out of hand. He had so many there they just weren't very useful any more. I thought about whether such a thing could really happen and decided, yes, to a degree but not quite as far as the story went.

Subject 23: I just thought about Lester making all those lists and being a pest.

Subject 24: I thought I didn't like writing lists very much because they took up too much time.

Four high divergent and one low divergent reader responses indicated that their approach was analytical although they were not critical. Many elaborated at great length and their comments indicated that they were seeking reasons why Lester acted the way he did. Their approach could be labeled psychological. This group also contained all but one of the subjects who mentioned that they had formed visual images. Two of the three divergent thinkers and the one less divergent thinker in this category mentioned this fact.

Subject 2: He wanted to be like everybody else and make lists or maybe like his mother. He did not think independently and have his own ideas. He liked to keep himself busy all the time and was very active and he kept up with his school work I guess like reading and was sort of very smart looking and acted pretty smart and everything.

Subject 5: I thought of what would happen if somebody really did make lists like that and what would happen to them and well I kind of made pictures of what his friends were thinking of him because he was making lists of them and he kept forgetting things and his friends didn't like him any more after he was making out all the lists. Also his mom probably started getting a little fed up with him and probably didn't maybe trust him as much after he was forgetting everything because of these lists and she probably also felt kind of mad because she had sort of influenced him making these lists.

Subject 15: Sometimes children get confused. They imitate their parents but don't understand why their parents are doing things. It reminded me of when I was little and used to copy my mother. Once Mom was babying a sick plant she got for her birthday by watering it a little every day. I thought I could help but I drowned the plant. Now Mom explains to me why she does things and as I get older I ask questions. I don't just jump to conclusions. I pictured the story in my mind as I read it.

Subject 32: I was just wondering why a little kid like him was writing all those lists. I just pictured this little kid in my mind in his room filling up lists, overwhelmed with lists.

Table 10
Type of Link to Past Experience

Type of Link	High Divergent	Low Divergent
Association only	6	2
Analytical-critical (judgment)	5	3
Analytical-elaborative (psychological)	4	1
None	5	14

In conclusion, when questioned about whether they connected the story to their own past experiences, many more high divergent than low divergent thinkers indicated that they were recalling past experiences as they read the story. Readers gave a variety of answers to indicate what kind of thought processes they were using to aid in comprehension of the written text. These included associating their past experiences to the text and using an analytical - critical or analytical - elaborative approach. Thus the association process was used in at least three different ways by different readers (all of which is classified under text experiential) but not consciously used by some readers to assist them in remembering the story. The students' answers to this question add further insight into the processes used and augment the statistical data reported in the previous section of this chapter.

Question 2

Did you use any particular way to remember the story? That is, did you use any special method to help you recall any part of the story?

Replies

More low divergent than high divergent thinkers reported having a conscious method for helping them to remember the story, as nine high divergent but only four low divergent readers said that they had no method. There were a number of different methods used and those listed below in Table 11 can generally be thought of as requiring progressively more cognitive manipulation by the reader. Reading carefully or slowly or rereading were the favorite methods of the low divergent thinkers, as just over half of them (11) reported using one of these two methods. However, only one-quarter of the high divergent thinkers used one of these two methods. Equal numbers of both groups said that they "thought about" the selection (three each). This was frequently combined with reading carefully or rereading. One high divergent student said she thought about and memorized the selection. Two low divergent students had a more systematic way to "think about" the selection. One reported that he "reviewed" the whole selection and one that she reviewed it in two parts (at the end of each page). Three of the high divergent and three of the low divergent reported that they tried to selectively remember. For four of these readers (an equal number in each group), remembering the lists or the words was most important. Two high divergent and one low divergent student said that they formed mental images to help them remember the story. This required converting the verbal information into visual information. Of these, three of the four were classified as using analytical - elaborative thinking as they read the story.

Table 11
Methods of Remembering Used by Readers

Method	Type of Reader	
	High Divergent	Low Divergent
No method	9	4
Nodded head and moved lips	0	1
Read carefully, slowly	2	5
Reread	3	6
Thought about	3	3
Reviewed	0	2
Selectively remembering	3	3
Mental image	2	1
Looked at pictures	1	1

(The other was classified under analytical - critical.) Only one student in each group mentioned that he/she looked at the pictures. Finally one low divergent student said that when he wanted to remember he nodded his head and moved his lips, a device which seemed to have no cognitive component. He read part of the selection with an audible whisper.

In conclusion, more low divergent than high divergent students reported having a conscious method for remembering the story. Their favorite methods were reading slowly or carefully or rereading. These two techniques involve thoroughness, a trait of convergent rather than divergent thinkers. No other generalizations can be made because of the small number (and fairly equal distribution) of students using other methods.

Summary

There was no significant difference in the reading processes of good sixth grade readers who were high in divergent thinking ability from those who were low in divergent thinking ability when the two groups were compared on all the categories simultaneously. However, when categories were treated individually and the correlation between categories was ignored, some differences between high and low divergent groups appeared in the text experiential, text inferential, text specific and text entailed categories.

The recall data suggest that the highly divergent thinker is more likely to utilize his/her past experience to assist in remembering the text and that in this respect the cognitive processes used in reading may be different for high and low divergent readers. The

associations made by highly divergent students are frequently not the kind that are restrained by the text. This type of reader embellishes and elaborates on the text. However, not all high divergent readers utilize this association process in the same way. Some only associate, while others use a more analytical approach, which may be critical or non-critical (and in the latter case tends to be more elaborative and psychological). Sentence verification data indicates a significant difference in the text inferential category. Divergent thinkers were better able to recognize text inferential statements. However, correlational data indicate that those readers who scored low on the Torrance test scored higher in the text specific category as they recalled a greater percentage of text specific clauses. This indicated that the associating - transforming processes were used more by students who scored low on the divergent test. The correlational data using the sentence verification results indicate that low divergent thinkers may also be better able to synthesize and construct text entailed information. Subsuming information from more than one unit of the text under a superordinate statement is a convergent type of activity. Thus the less divergent student may be better able to produce generalizations and summaries. The descriptive data indicated that the combination of processes, associating - elaborating (which includes associating - criticizing), appear to be more highly developed in the divergent reader as a technique for remembering text. The high divergent reader may also have a more developed ability to make inferences using his past experiences. The less divergent reader appears to compensate by using a more structured approach, that is a conscious method of remembering.

The high divergent thinkers performed slightly better than the

low divergent thinkers on the recall task but the advantage went to the low divergent thinkers on the sentence verification task. While few of the differences between the high and low divergent thinkers were significant on either task, some discrepancies between results on the two tasks suggest that specific categories may not be measuring identical processes. This was also indicated by the fact that correlations between scores on the two tasks were generally not significant.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary of the Study

The major purpose of the study was to compare the reading processes used by good readers who were high in divergent thinking ability with good readers who were low in divergent thinking ability. Forty students who scored above the seventy-fifth percentile on the Edmonton Public Schools' Elememtary Reading Test were chosen for the study. I.Q. was held constant. Of the seventy-three who were given the Torrance Test of Creativity (Verbal) the twenty who received the highest scores (the high divergent) and the twenty who received the lowest (the low divergent) formed the two groups. Each student in these groups was tested individually and read a five hundred word narrative selection after which he/she gave an oral recall, completed a sentence verification task and answered two questions.

The unaided recall of each student was recorded on tape and transcribed. Then the recalls were divided into clausal units which were categorized in terms of their relationship to the original text. Because the recalls of the high divergent group averaged one-fifth longer than the low divergent group, percentages of total recall figures were used for comparison purposes. The scores on the sentence verification task, which was constructed using these same categories, were also tabulated to assist in determining the processes used by the readers. Then the answers to the two questions were categorized.

Statistical measures used to analyze data included Hotelling's multivariate analysis and Pearson's correlations.

Major Findings and Conclusion

Both the recall and the sentence verification task data showed that there was no significant difference in the reading processes of good sixth grade readers who were high in divergent thinking ability from those who were low in divergent thinking ability when the two groups were compared on all the categories simultaneously. However, when individual categories were considered, results on the recall and the sentence verification tasks revealed both similarities and differences between the high divergent and the low divergent groups. Approximately half the clauses recalled by both groups were in the text specific category. That is, there was specific reference made to the text, but it had been transformed by a reordering of information or substitution of lexical items. However, there was a significant negative relationship between Torrance scores and the proportion of recalls in this categoroy.

The two groups also differed on the recall data in that high divergent thinkers recalled a greater proportion of clauses in the text experiential category than did low divergent thinkers. It appeared that high divergent readers were using the processes of associating and elaborating more than low divergent readers on the recall task. High divergent readers were connecting their past experiences to the text even though this was not necessary to "fill in the gaps". This information was not constrained by the text. Correlational results for the recall data also showed a significant

relationship between divergent thinking and performance on the text experiential category.

The sentence verification data did not confirm that high divergent readers were more able at performing the processes of associating and elaborating. The anova analysis for the sentence verification data showed that high divergent readers scored significantly better only on the text inferential category. From this one would conclude that high divergent thinkers were better able to use past experience to "fill in the gaps" of the text. However, correlation data did not confirm a significant relationship of divergent thinking with use of past experience on either the text inferential or text experiential categories.

Correlation data showed that the only significant relationship between Torrance scores and sentence verification scores was on the text entailed category and that this relationship was negative. It perhaps reflected the more convergent nature of this synthesis task. Readers were required to subsume information from different parts of the text under a superordinate statement and the number of appropriate superordinate statements was extremely limited. Most other relationships between Torrance scores and the sentence verification scores were ~~also~~ negative, which was predictable considering the convergent nature of this task. However, other differences were not large enough to be significant.

While the recall and sentence verification tasks appeared to provide global measures of reading processes, they did not always measure the same thing when specific categories were considered, or if they did there were other confounding factors which so greatly influenced the results in this study that these similarities were

overshadowed. The recall task was the more divergent of the two tasks, requiring the reader to provide his/her own structure, and also was a more risk-taking activity. The sentence verification technique was more structured, and therefore a more convergent type of activity. These differences in tasks were reflected in the relative performance of the high and low divergent thinkers.

The descriptive data provided interesting additional information, confirming use of past experience by high divergent readers. Three-quarters of the high divergent readers but only just over one-quarter of the less divergent readers said that they connected the story with their past experiences. However, not all the high divergent readers used their past experiences in the same way. Some associated only, some were analytical and critical and some who were analytical tended to elaborate on the text using a psychological approach.

Overall, reading processes for all good readers appeared to be similar but there were differences, particularly in their ability to use past experience. Those readers who did not make conscious use of their past experience frequently made conscious use of a more structured technique for remembering the text. Readers also differed in their ability to perform different types of tasks which purported to provide data on their reading processes. This is an important factor to take into account when determining what processes are actually used.

Implications of the Study

Measuring

As different tasks favor different cognitive styles, care must be taken that any test results are actually indicative of the processes one is attempting to measure, not a measure of the cognitive style of the testee. As almost any appproach will favor a certain cognitive style, a well balanced testing device might combine a variety of approaches. Two differences in cognitive style are divergent and convergent thinking. Unstructured tasks favor the high divergent thinkers; structured tasks favor thinkers with a more convergent approach. High divergent thinkers performed better on the recall task. They showed that they were more comfortable performing this task by giving longer and more complete recalls. Low divergent thinkers performed somewhat better than the high divergent thinkers on the sentence verificatiton task. Thus, as well as there being actual differences in the processes used, it also appears that different types of tasks used for testing favor students who have either developed or innate abilities which prepare them to excell in the required task.

Although different people have different cognitive styles which are relatively stable over time, they are not unchangeable (Witkin, 1977). The testing methods used in the schools may be training students to be convergent thinkers, because at least where classes are large or there is a desire to compare students in large groups (as in departmental examinations), the multiple choice exam is favored by teachers and administrators. If divergent thinking is valued, then there should be more opportunities for students to develop their own

methods of organizing material and utilizing these methods in a testing situation.

Theory

Although the way good readers process the written text was basically similar for all, there were important differences. The recall categories helped the researcher to focus on the similarities and differences between the processes used by the high divergent and the low divergent thinkers. All readers were associating about half the time, which indicated that usually readers structured their recalls into the same units used by the author but frequently used their own words. However, it was in the extension of this association process to include the conscious use of past experiences that divergent and less divergent thinkers differed. The divergent thinkers made more conscious use of their background knowledge. They were more aware of their past experiences and perhaps were conscious that reading was an interactive process. It was particularly evident that they elaborated more on the text and this appeared to be a method of remembering the text. What was not evident from the study is how much less divergent readers unconsciously use their past experience. Even those students who did not consciously use their past experience to remember the text would at least have had to use their past experience to define the words in the text and to use the grammatical structure to interpret meaning. It is possible that these readers are subconsciously using their past experiences in other ways as well. This is illustrated by the fact that there was no significant difference between the high and low divergent thinkers on the text experiential category for the sentence verification task and on the

text inferential category on the recall task. Thus the data do not refute a transactional theory of reading but tend instead to support the theory that the low divergent thinker makes less conscious use of his/her past experiece as a method to remember what he/she reads. For the short reading selection used in this study less divergent readers were able to remember the text anyway, frequently with the help of a structured method for remembering. The results might be different if they tried to remember a longer reading selection or if they tried to remember for a longer period of time.

Practice

High divergent readers appeared to be able to provide the structure to remember what they had read, since their recalls were generally longer than those of low divergent readers. It was the low divergent readers who performed better when provided with the structure of the sentence verification task. Also, many low divergent readers indicated that they used structured methods to help recall text materials, for example rereading. However, since their unaided recalls were not as complete as those of high divergent readers, they may need to develop a more extensive repertoire of strategies for remembering what they read. Teaching these conscious strategies to less divergent thinkers might result in the biggest improvement in reading comprehension scores, at least in the short term. This does not preclude attempting to enrich the life experiences of both groups of readers to give more experiences to which the reader can associate the written text. Witkin (in Guilford, 1980) found that as children grow older they move toward the field - independent end of the field-dependent — field-independent scale. Possibly readers become

more divergent, or at least better able to handle divergent tasks, as they gain in the number of past experiences, develop more independence and/or more self confidence.

Understanding the basic methods of thinking of a reader makes it possible to help him/her make most efficient use of the cognitive style with which he/she is most comfortable and therefore uses most frequently. But there is also good reason to teach a learner an alternate learning style, because increased adaptability and versatility is a decided advantage as different approaches are effective for different types of tasks.

Suggestions for Further Research

The major differences in the processes used by the high and low divergent thinkers appear to be in their ability to make and/or use past experiences to elaborate or "fill in the gaps". Further study could provide a better understanding of the differences. Both the reading selection and the period required to retain the information were short in this study. Would increasing the length of the selection result in greater use of past experience to organize information for recall? Would connecting past experiences to the text read improve the likelihood of good long term retention or would it cause confusion in the mind of the reader?

What would be the results of studies using different populations? As readers mature and get older do they become more divergent, in that they are better able to use their past experiences to assist in interpreting text? How are other socio-economic groups different from the group studied? Are poor readers more or less divergent than

good readers? What would be the effect of a second language? Initially would it delay the development of an adequate language base so that the child was handicapped when trying to connect with past experiences? In the long term would it increase the possibilities for a wider range of experiences and increase opportunities for associating past experiences with text read?

To what extent can reading scores be improved by training in divergent thinking? Hicks (1980) found that inferential reading scores could be improved. Will further research substantiate this claim?

What are other cognitive style variables that affect the reading process? The cognitive categories used by Pitts and Thompson (1982): field dependence-independence, reflective-impulsive, breadth of categorization and the ability to attend to relevant stimuli; could have different correlations with reading comprehension. Relating these dimensions of cognitive style to reading processes instead of one reading comprehension score might yield valuable information. The correlation of many other dimensions of cognitive style to the reading processes may have important implications for the teaching of reading also.

Concluding Statement

The reading process is not identical, even for all good readers. This research has compared readers who were high with those readers who were low in divergent thinking ability and found that one dimension on which readers differ is in their ability to utilize past experience. Even those who do utilize it do not all do so in the same

way. There are doubtless many other ways in which good readers differ in the processes that they utilize for reading comprehension.

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APPENDICES

APPENDIX A. READING SELECTION

Lester, the Lister

Lester was fascinated with lists. He watched his mom making up the grocery list. He noticed that she made a list of things she sent to the dry cleaners. He saw a list of names she wrote down when she was planning to have a party. Lester decided to make lists.

At first Lester's lists were very short. He would get up in the morning and before breakfast he would compose his list: have breakfast, go to school, have lunch, go back to school, come home, play, have supper, play, go to bed. Then he began to make more lists and the lists got longer and more detailed. He made a list of what he'd have for breakfast: fruit juice, toast, egg, milk. Then he decided he needed a special list called: kinds of fruit to eat for breakfast. On that list he wrote: grapefruit, orange, tomato, apple, cranberry, and grape. He listed kinds of toast: whole wheat, whole earth, cracked wheat, diet thin, vitamin enriched white, and raisin. His breakfast lists got more complicated when he had to make a list for: what to put on toast, different ways to cook eggs, and names of cereals.

Lester was often late for breakfast because he was working on his lists. He had to have long strips of paper handy to write on. And he had to have lots of space to put his lists on display. His mother said his room was a disorganized mess. He said it was very well organized. He knew just where to find every list. That was because he had a list of lists.

Lester's mother made a rule. He could not write down anything before breakfast. Then he was late for school. Between breakfast and nine o'clock he didn't have enough time to write down things to look for on the way to school, things to take to school, friends to meet on the way, and so on.

Lester had trouble finding places to keep his lists. Some were in a drawer in his bedroom, a few were stuck on the refrigerator door with a magnetic button, some were in his desk at school, and of course there were always a few in his pockets.

One day when Lester was watching his mother make out her list of family birthdays he asked her a question. "Why do you make lists, Mom?"

"I make them to save time," she replied, "and so I won't forget important information. Lists make life easier."

Lester made a list of reasons and it took him twenty minutes. He also forgot baseball practice, which was on a list in the tool kit on his bicycle. Baseball was top of the list of Lester's favourite sports and bicycle riding was second.

Lester realized his lists were getting him into trouble. He made his last list and put it up beside his bed. It was called: Reasons that Lester is giving up making lists. The next day he read it, took it seriously, and had a very pleasant day.

(Language Development Reading Evaluation Resource Book for Toboggans and Turtlenecks, 1980,pp. 18-19)

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APPENDIX B

METHOD USED FOR CODING PROTOCOLS

(Fagan, 1983, pp. 7-24 to 7-26)

Eliminating Irrelevant Data

1. Mazes

(i) Filled Pause (audible noise) : This consists of sounds which may be represented as ah, er, um, etc.

(ii) Filled Pause (interjection) : This consists of words or phrases which seem to mark time for the speaker before going on to the next thought. Examples are well, I think, yes, let me see, wait a minute, etc.

(iii) Filled Pause (Repeat) : This includes the repetition of words or parts of words.

He saw a golf cart - a golf cart.
The little girl was per - perturbed.

(iv) Correction/Edit : This consists of a jumble of words preceding a change in direction of what the person was about to say, or preceding a better choice of words.

He wanted to sell - to buy the golfballs.

The boy collected golfballs in the - around where - where he - on the golf course near where he was lived.

Each group of words in a maze represents only one instance of a filled pause or correction/edit whether it is a number of different words or a repetition of the same word.

2. Recall Conventions are concerned more with the narrating than with the actual content of the text. They may express a reader's

limitations in not being able to remember or may include vague generalizations which appear to be a cover-up for lack of specific knowledge. Following are examples of recall conventions.

Text: (no specific referents)
Protocol: "Well it says that..."
"And in the second paragraph the story says..."
"And that's all I can remember."
Protocol: "That was a good story."
"I found it hard to remember the part where all the characters were introduced."

Also included are phrases used by the reader to insert an event in proper sequence due to forgetting while recalling.

Protocol: Before that he set out his hooks for fishing.

The "before that" acts as an addendum to insert information in its proper sequence after subsequent information had been recalled. A synonymous statement to "before that" would be "I forgot that".

Choosing a Unit for Analysis

A study by Fagan and Currie (1982) compared the results of using the t-unit/incomplete t-unit, the clause, and the syntactic proposition in analyzing recall protocols. Results showed that the use of the t-unit / incomplete t-unit and clause produced very similar profiles even though the number of units differed (502 t / incomplete t-units and 615 clauses).?

APPENDIX C

ANALYSIS CATEGORIES

A. TEXT EXACT

This category includes information from the text in its exact form or with minimal variations. It is assumed that this information was stored in rote fashion or is automatically constrained by other information and is "reproduced" in a similar state.

A1. Verbatim Recall

The information is a direct recall of the lexical items of text.

Text: The boys were late for school.
Protocol: The boys were late for school.

Substitution of a determiner, a verb form or a function word which does not change the meaning of the unit will also be placed in this category.

Text: He chased the animal.
Protocol: He chased an animal.

Text: People were waiting at the door.
Protocol: People were waiting by the door.

Text: The student had been absent many times.
Protocol: The student was absent many times.

A2. Partial Recall

A significant concept(s) (noun, verb, attribute) is/are omitted in the verbatim recall.

Text: After robbing the store, the convicts raced for their car.

Protocol: The convicts raced for their car.

Text: The children had never seen such a tiny colt.
Protocol: The children had never seen such a colt.

A3. Vague Statements

A reader uses at least one term which is exact from the text. This is usually the subject or head word of the statement. With this head word there is a relational statement which is not incorrect in terms of the text data but is vague in the sense that it may have been produced without noting specific text referents.

Text: (describing the manufacture of various items of clothing)
Protocol: They made many kinds of things.

B. TEXT SPECIFIC

In this category is placed information recalled that has specific references within a single unit in the text. The reader may have "transformed" some of this information by reordering or substituting lexical items.

B1. Substitution of Pronouns

A pronoun is used in place of a noun within the text unit.

Text: People were very kind to the stranger.
Protocol: They were very kind to the stranger.

Text: The truck went off the road about one half mile from the settlement.
Protocol: It went off the road about one half mile from the settlement.

B2. Synonymy of Elements

The operational definition of synonymy is context dependent and may refer to (a) substitution of one word for another so thhat semantic and grammatical features are preserved, (b) the sequencing of lexical items from a unit such as the preposing of prepositional phrases or substituting an active for a passive, and (c) a paraphrase of the original unit which in the

subjective opinion of the scorer has the same conceptual referents and has definite correlates in the text unit. The protocol unit and the text unit should evoke similar specific referents.

Text: fish
Protocol: salmon

Text: The house was on fire.
Protocol: The house was burning.

Text: In twos and very slowly the mourners walked in procession.
Protocol: The mourners walked in procession very slowly and in twos.

Text: He said good night and went to bed.
Protocol: He decided to call it an evening and said good night.

C. TEXT EMBEDDED

This information in this category is specific to the text but the unit of recall includes information from more than one unit of the text.

C1. Embedded Information

Embedding occurs when lexical items from two or more separate utterances are combined into one. The utterances may be contagious or may be separated in the text. At least one of the specific key items or its synonym is used in the embedding. The observer should be able to match up the information in the embedded unit to the information in the original items.

Text: She jumped into the icy water. She was trying to save the swimmer who was in trouble.
Protocol: She jumped into the icy water to save swimmer in trouble.

Text: The stranger pitied the man. He had tried to help but had not been very successful. The stranger felt deep remorse but knew that the man would have to settle his own problems without outside interference. The stranger stared quietly as the man walked slowly away.
Protocol: The stranger pitied the man who walked slowly away.

C2. Noun/Pronoun Substitution

Information in one text unit is designated by a noun and in another text unit by a pronoun. When the reader recalls these units he/she uses only the noun or the pronoun for this concept.

Text: The man won the lottery. He was so happy.
Protocol: The man who won the lottery was so happy. Or, He was so happy because he won the lottery.

D. TEXT ENTAILED

The information retrieved is a superordinate statement subsuming information from more than one text unit. It may be assumed that at the time of comprehending, the reader "constructed" information and retrieves this construction at the point of recall or that the reader reconstructed the information at the time of recall.

D1. Synthesis

A synthesis is a compilation of information from one or more text units. It does not contain key lexical items from the specific units summarized but is expressed in a hierarchical or superordinate manner, or by a generalization. In reverse, the text unit(s) is/are actually an elaboration of the summary statement. However, unlike synonymy of elements(B2), the specific concepts of the text cannot be known from the recall statement.

Text: He quickly raced to the landing, stripped off his clothes and jumped into the icy water. His only wish was to rescue the frightened little boy.
Protocol: He did a very brave deed.

Text: While visiting her Aunt Lizzie at the farm last weekend, Terri helped harvest some carrots, peas, zuchini, and tomatoes. (Note that in contrast to B2, the specific concepts of the text unit cannot be recovered from the protocol unit. However, the text unit does allow for an elaboration of "vegetables").

E. TEXT INFERENTIAL

This information is added by the reader to fill in gaps in the text data and is derived from knowledge schemas of world events, such as a rodeo, restaurant, school. This information may have been constructed at the time of input and retrieved at recall or reconstructed at the time of recall. Unlike Synthesis (D1), the text does not provide an elaboration or expansion of the referents. Additional data to the text information must be generated by the reader. That is, a gap must be bridged.

E1. Inference

An inference may include either a logical reasoning or an instantiation, that is, the filling in of information but not specified. The latter is not often referred to as a pragmatic inference and may be stated in a contradictory form and still make a plausible statement.

Text: John and Bill left for school at the same time and walked at the same rate. But Bill lived several blocks farther away than John. John just reached the school on time.
Protocol: (Logical): Bill was late for school.

Text: The mother bundled the children in their parkas, scarves and mittens. She was sure they all had a hot lunch as they left for school.
Protocol: (Pragmatic): It was a cold day.
(Contradiction: It was not a cold day. Perhaps the mother was mentally deranged).

F. TEXT EXPERIENTIAL

This information consists of elaborations or embellishments which are triggered off by associations to the text information. They are not constrained by the text in the same way as inferences; that is, while two independent observers should agree on the inference, such agreement would not be expected for elaborations. The reader is empathesizing from experience.

F1. Experiential Intrusions

This information is related to the theme of the text passage but is not specifically suggested by a particular unit in the text. It does not convey the text information but is an addition of information from the reader's background.

Text: The little boy had disobeyed his mother. She had told him to wait by the car while she went back to the store for the other bag of groceries. Now she could not find him anywhere.
Protocol: One time I saw this woman looking everywhere for her little boy. He went up the escalator when she wasn't looking.

F2. Storyline Additions

These units include additions to the information within the storyline. The origin of these additions appears to be based on the reader's experience with stories and the kinds of goals or actions which are appropriate in a particular context and thus are predictable from the story information. also included are expressions that indicate saying, thinking, etc. which are not specifically stated in the text. These are not inferences since they are not immediately constrained by a specific part of the text.

Text: (describing a character's actions that led up to making a decision)
Protocol: He thought he would catch the next train and finally settle the matter completely.

Text: The stranger saw that the man was weak and finally dug a hole through the ice for him.
Protocol: The man said "I am not able to dig the hole." But the stranger said "You got to keep trying and trying." The man said "I just can't do it."

G1. TEXT ERRONEOUS - SPECIFIC

The category contains information that is erroneous within Categories A, B and C and relates to errors in specific text information.

G1a. Errors in dates and proper names

These errors constitute memory errors or are due to lack of attention to the text. The appropriate slot is there but is inaccurately filled.

Text: Sir Wilfred Laurier
Protocol: Sir Wilfred Bennett

Text: 1864
Protocol: 1872

G1b. Erroneous expansions/additions

These units (i) separate attribute/argument phrases into units that are conceptually wrong, or (ii) add information that is contradictory with information in the text. These may be due to lack of experience with the content and/or the ambiguity of the text.

Text: They ground corn by pounding it.
Protocol: They ground corn by heating it.

Text: The lobster's claws.
Protocol: The lobster claws.

G1c. Erroneous Embeddings

In combining information the reader confuses information about a particular referent.

Text: As the man was scraping snow off the ice he saw someone standing beside him. The man said to the stranger "I don't think I can finish visiting my lines because I am so cold and hungry." The stranger said he would help. He dug new holes for the man and also showed him where to get caribou.
Protocol: A stranger came along. He helped the man dig holes through the ice and then they saw a caribou herd go by.

Text: Mrs. Gray sat down to watch the TV announcer on her weekly show about gardening.
Protocol: Mrs. Gray sat down to watch the TV announcer on his weekly show about gardening.

Text: The dogs lay down and refused to move. The man dragged the sled all the way to the cabin.
Protocol: The dogs dragged the sled to the cabin.

G2. TEXT ERRONEOUS - NON SPECIFIC

The erroneous information in this category is incorrect in relation to Categories D, E and F. This erroneous information may be due to faulty construction at the time of input or faulty reconstruction at the time of recall.

G2a. Inaccurate/incorrect synthesis

Information from the text is (i) designated by an inaccurate superordinate referent, (ii) is generalized in a way which does not convey the gist of the passage, or (iii) contradicts real life events not mentioned specifically in the text.

Text: We shouldn't always knock computers when they seem to make an error on our accounts. Granted we might be upset when our balance is nil and the computer still insists that we send a check for $40.00. However, if computers were assigned to do the many menial tasks of administrative affairs and leave more time for humans to use their intelligence to solve the more significant problems, then computers and humans would be compatible and would coexist in harmony.
Protocol: Computers are taking over.

Text: While visiting her Aunt Lizzie at the farm last weekend, Teri helped harvest some carrots, peas, zucchini, and tomatoes.
Protocol: Last weekend Teri helped her Aunt harvest some fruit.

G2b. Faulty Inference

The reader draws an incorrect inference from the information given in the text.

Text: Mrs. Gray knew it was two o'clock because she could hear Henry, her parrot squawking. He wanted to watch his favorite TV program. But Mrs. Gray thought that too much TV was

bad for Henry's eyes so she told him to rest instead. He squawked even louder so she finally turned onthe TV set. After Henry's show was over, she stayed to watch a show on cooking.

Protocol: Mrs. Gray came in from the garden to watch her TV show.

G2c. Inaccurate World Information

The information is inaccurate or contradicts known world knowledge.

Text: (About a skiing trip but not mentioning any particular country.

Protocol: Canada is the only place where skiing is a popular sport.

APPENDIX D

SAMPLE OF AN ANALYZED RECALL PROTOCOL (READING COMPREHENSION)

Lester the Lister

(there was this younger boy named) Lester (and he saw his mother making)(he) liked lists (B)/ and he saw his mom making (a list) a grocery list (B)/ and he was interested (E)/ so (he started making lists) he started making lists (B)/ about (like) what he'd do during the day like eat breakfast, go to school, come home from school, eat lunch (and something like that) (D)/ and then he got (more) more into something and started writing (like) like what to eat for breakfast, what friends to meet on the way to school (C)/ what you were going to do at school (F) (and things like that)/ and he kept on going more and more (F)/ and he ran out of room to put his lists (B)/ and (one time just at the very end) he saw his mom making a list of birthdays (B)/ and he asked his mom (B)/ why they make lists (G)/ and she said (B)/ it makes life easier (B)/ just to help you remember things (B)/ so he wrote up another list (B)/and (then he) it was about (B)/ (like) why he was going to give up lists (B)/ (at the very) in the morning he read it over and decided (E)/ it was good (E)/ and he had a good day (B)/

Please see the next page for the classification of protocol clauses.

Clauses in Recall Categories of Sample Protocol

Type of Clause	Number	Per Cent
A - Text Exact	0	0
B - Text Specific	13	61%
C - Text Embedded	1	5%
D - Text Entailed	1	5%
E - Text Inferential	3	14%
F - Text Experiential	2	10%
G - Text Erroneous	1	5%
Total	21	100%

APPENDIX E

SENTENCE VERIFICATION TASK

(Copy of Pages Given To Students)

Sentence Verification Task

On the next pages are some sentences. Put a circle around the number of each sentence that is true in terms of the story. That is, you can know it from the story.
DO NOT LOOK BACK AT THE STORY.

Here are two sample questions.
We will do them together.

1. Lester's mother made lists to amuse herself.

2. Lester had trouble finding places to keep his lists.

TURN THE PAGE AND BEGIN

1. His breakfast lists got more complicated when he had to make a list for names of cereals.

2. He saw the list of names she wrote down when she was planning to entertain.

3. Lester was spending too much time making lists to have any time left over for organizing his room.

4. He said it wasn't very well organized.

5. Lester kept his lists at home and at school.

6. On that list he wrote: orange, grape, cracked wheat and raisin.

7. At first his lists were very short.

8. Lester's mother said "Lists make life easier by helping me remember and saving me time."

9. Then she began to make more lists and the lists got longer and more detailed.

10. Most people don't care if lists are useful, they just like to write them.

11. He had to have long strips of paper handy to write on.

12. Lester's mother gave him the idea that list making was a good thing to do.

13. Lester's mother didn't mind when he was late for breakfast.

14. People who make lists like to be organized.

15. Lester had not learned when making lists would be helpful for him.

16. Lester's mother made the rule because Lester was often late for breakfast.

17. Breakfast was not an interesting meal for Lester.

18. Lester's fascination with making lists would soon have died anyway.

Key for Sentence Verification Task

Question Number	Category
1	A
2	B
3	E
4	A-
5	D
6	C-
7	B
8	C
9	B-
10	F-
11	A
12	E
13	E-
14	F
15	D
16	C
17	D-
18	F